CLAIMS

Sub Q'

1. A camera comprising:

a camera lens;

acquisition circuitry receiving images via said camera lens, for acquiring a first field of view when said camera lens is in a first orientation and for acquiring a second field of view when said camera lens is in a second orientation; and

a viewfinder displaying the second field of view when said camera lens is in the second orientation and displaying at least a portion of the first field of view at least partially composited with the second field of view.

2. The camera of claim 1 wherein the second field of view at least partially overlaps the first field of view.

3. The camera of claim 1 wherein a size of the at least a portion of the first field of view is prescribed.

4. The camera of claim 3 wherein the size of the at least a portion of the first field of view is prescribed relative to a size of the first field of view.

5. The camera of claim 3 wherein the size of the at least a portion of the first field of view is prescribed relative to a size of the second field of view.

6. The camera of claim 5 wherein the size of the at least a portion of the first field of view is its width, and the size of the second field of view is its width.

7. The camera of claim 5 wherein the size of the at least a portion of the first field of view is its height, and the size of the second field of view is its height.

8. The camera of claim 5 wherein the size of the at least a portion of the first field of view is the field of view angle it subtends, and the size of the second field of view is the field of view angle it subtends.

9. The camera of claim 5 wherein the size of the at least a portion of the first field of view is prescribed to an amount between 20% and 40% of the size of the second field of view.

10. The camera of claim 1 wherein the at least a portion of the first field of view is composited with the second field of view by an opacity of approximately 50%.

11. The camera of claim 1 wherein the at least a portion of the first field of view is composited with the second field of view by an opacity of approximately 100%.

12. The camera of claim 1 wherein the focus of said camera lens is not changed during acquisition of the first and second fields of view.

13. The camera of claim 1 further comprising a lens focus lock for locking the focus of said camera lens during acquisition of the first and second fields of view.

14. The camera of claim 1 further comprising combining circuitry for combining the first and second fields of view.

15. The camera of claim 14 wherein the first and second fields of view are portions of a scene and wherein said combining circuitry combines the first and second fields of view into a panoramic image of the scene.

16. The camera of claim 15 wherein said panoramic image has a cylindrical geometry.

17. The camera of claim 16 further comprising rectilinear-to-cylindrical conversion circuitry for converting the first and second fields of view from rectilinear coordinates to cylindrical coordinates.

18. The camera of claim 15 wherein said panoramic image has a spherical geometry.

19. The camera of claim 15 further comprising rectilinear-to-spherical conversion circuitry for converting the first and second fields of view from rectilinear coordinates to spherical coordinates.

20. The camera of claim 15 further comprising view control circuitry for selecting a portion of the panoramic image to display, and wherein said viewfinder displays the selected portion of the panoramic image.

21. The camera of claim 20 wherein said panoramic image has a cylindrical geometry and further comprising cylindrical-to-rectilinear conversion circuitry for converting the selected portion of the panoramic image from cylindrical coordinates to rectilinear coordinates.

76. The camera of claim 73 wherein said color alignment circuitry also adjusts the color values at multiple pixel locations within the second frame based on the brightness and contrast parameters.

77. The camera of claim 76 wherein said color alignment circuitry applies opposite brightness and contrast adjustments to the first and second frames.

78. The camera of claim 67 further comprising color alignment circuitry for adjusting the color values at multiple pixel locations within the second frame based on the brightness and contrast parameters.

79. The camera of claim 78 wherein said color alignment circuitry applies 100% of the brightness and contrast parameters within a region of overlap of the first frame and the second frame.

80. The camera of claim 78 wherein said color alignment circuitry applies approximately 75% of the brightness and contrast parameters within a region of overlap of the first frame and the second frame.

81. The camera of claim 54 further comprising stitching circuitry for compositing a portion of the second frame onto a portion of the first frame.

82. The camera of claim 81 wherein said stitching circuitry replaces color values at multiple pixel locations within the first frame with values that are weighted averages of color values in the first frame and color values in the second frame.

83. The camera of claim 54 wherein data strips from the first and second frames are incrementally stored within the panoramic image as the frames are at least partially combined.

84. The camera of claim 83 further comprising a far edge delimiter and a near edge delimiter and wherein data from a portion of the first frame between said far edge delimiter and said near edge delimiter is stored within the panoramic image.

85. The camera of claim 54 wherein said acquisition circuitry acquires at least one additional frame with said camera lens being in at least one additional orientation, and wherein said combining circuitry at least partially combines the at least one additional frame into the panoramic image.

86. The camera of claim 85 further comprising motion estimation circuitry located within said camera housing for determining horizontal and vertical offsets for spatially aligning two selected acquired frames.

87. The camera of claim 86 wherein said motion estimation circuitry comprises sum-of-absolute-difference circuitry for summing absolute values of color differences between the two selected acquired frames at a multiplicity of pixel locations.

88. The camera of claim 85 further comprising color blending circuitry for determining brightness and contrast parameters for chromatically aligning two selected acquired frames.

89. The camera of claim 88 wherein said color blending circuitry comprises color statistic circuitry for calculating means and variances of color values at a multiplicity of pixel locations.

90. The camera of claim 85 further comprising stitching circuitry for compositing a portion of one of the two selected acquired frames onto a portion of the other of the two selected acquired frames.

91. The camera of claim 85 wherein data strips from the first and second and at least one additional frames are incrementally stored within the panoramic image as the first and second and at least one additional frames are at least partially combined.

92. The camera of claim 91 further comprising a far edge delimiter and a near edge delimiter, and wherein data from a portion of the first and second and at least one additional frames between said far edge delimiter and said near edge delimiter is stored within the panoramic image.

93. The camera of claim 54 further comprising:

a display for displaying at least a portion of the panoramic image; and

display control circuitry for selecting a portion of the panoramic image to display.

94. The camera of claim 93 wherein said panoramic image has a cylindrical geometry and further comprising cylindrical-to-rectilinear conversion circuitry for converting the selected portion of the panoramic image from cylindrical coordinates to rectilinear coordinates prior to display thereof.

95. The camera of claim 93 wherein said panoramic image has a spherical geometry and further comprising spherical-to-rectilinear conversion circuitry for converting the selected portion of the panoramic image from spherical coordinates to rectilinear coordinates prior to display thereof.

96. A camera comprising:

a camera lens;

a memory for storing data for a panoramic image;

a display for displaying at least a portion of the panoramic image; and

display control circuitry for selecting a portion of the panoramic image to display.

97. The camera of claim 96wherein said panoramic image has a cylindrical geometry and further comprising cylindrical-to-rectilinear conversion circuitry for converting the selected portion of the panoramic image from cylindrical coordinates to rectilinear coordinates prior to display thereof.

98. The camera of claim 97 wherein said cylindrical-to-rectilinear conversion circuitry comprises line processing circuitry for computing converted color values at pixel locations within a vertical line of said display.

99. The camera of claim 98 wherein said line processing circuitry computes converted color values at pixel locations within a vertical line of the display based on non-converted color values along a corresponding vertical line in the selected portion of the panoramic image.

100. The camera of claim 98 wherein said line processing circuitry rescales the corresponding vertical line in the selected portion of the panoramic image.

101. The camera of claim 96 wherein said panoramic image has a spherical geometry and further comprising spherical-to-rectilinear conversion circuitry for converting the selected portion of the panoramic image from spherical coordinates to rectilinear coordinates prior to display thereof.

102. The camera of claim 101 wherein said spherical-to-rectilinear conversion circuitry comprises line processing circuitry for computing converted color values at pixel locations within a vertical line of said display.

103. The camera of claim 102 wherein said line processing circuitry computes converted color values at pixel locations within a vertical line of the display based on non-converted color values along a corresponding vertical line in the selected portion of the panoramic image.

104. The camera of claim 102 wherein said line processing circuitry rescales the corresponding vertical line in the selected portion of the panoramic image.

105. The camera of claim 96 wherein said display control circuitry is responsive to movements of the camera.

106. The camera of claim 96 further comprising at least one display control button, and wherein said display control circuitry is responsive to pressing of said at least one display control button.

107. The camera of claim 106 wherein said at least one display control button includes at least one navigational panning button for navigation through the panoramic image in at least one direction.

108. The camera of claim 96 wherein said display control circuitry also selects a magnification factor for the selected portion of the panoramic image, and wherein said display displays the selected portion of the panoramic image at the selected magnification factor.

109. The camera of claim 108 wherein said display control circuitry is responsive to changes in focus of said camera lens.

110. The camera of claim 108 further comprising at least one view magnification button for zooming in and out of the panoramic image, and wherein said display control circuitry is responsive to pressing of said at least one view magnification button.

111. A method for combining a first frame and a second frame, comprising the steps of:

determining horizontal and vertical offsets for spatially aligning the first and second frames, comprising the step of summing absolute values of color differences between the first frame and the second frame at a multiplicity of pixel locations, based on trial values for horizontal and vertical offsets;

further determining brightness and contrast parameters for chromatically aligning the first and second frames; and

generating a panoramic image, comprising the step of compositing a portion of the second frame onto a portion of the first frame, based on the horizontal and vertical offsets and based on the brightness and contrast parameters.

112. The method of claim 111 wherein said summing step comprises the steps of:

computing partial sums of absolute values of color differences between the first frame and the second frame at pixel locations within horizontal lines, based on the trial values for horizontal and vertical offsets; and

accumulating the partial sums to form a complete sum of absolute values of color differences between the first frame and the second frame at a multiplicity of pixel locations.

113. The method of claim 112 further comprising the steps of:

repeating said steps of computing and accumulating for a multiplicity of trial values for horizontal and vertical offsets; and

selecting horizontal and vertical offsets from among the multiplicity of trial values for horizontal and vertical offsets, based on the respective complete sums.

114. The method of claim 113 wherein said selecting step selects horizontal and vertical offsets corresponding to a smallest local minimum value from among the complete sums.

115. The method of claim 111 further comprising the step of spatially aligning the first and second frames based on the horizontal and vertical offsets.

116. The method of claim 111 wherein said further determining step comprises the step of calculating means and variances of color values at a multiplicity of pixel locations within the first and second frames.

117. The method of claim 116 wherein said further determining step determines the brightness and contrast parameters in such a way that a mean and variance of color values at multiple pixel locations within the first frame are equal to the respective mean and variance of color values at corresponding multiple pixel locations within the second frame.

118. The method of claim 111 further comprising the step of chromatically aligning the first and second frames based on the brightness and contrast parameters.

119. The method of claim 111 wherein said compositing step comprises replacing color values at multiple pixel locations within the first frame with values that are weighted averages of color values in the first frame and color values in the second frame.

120. The method of claim 111 wherein at least one additional frame is combined with the first and second frames, the method further comprising the step of repeating said steps of determining, further determining and generating at least once for subsequent first and second frames from among the first and second and at least one additional frames.

121. The method of claim 120 further comprising the step of spatially aligning the at least one additional frame with another frame from among the first and second and at least one additional frames, based on the horizontal and vertical offsets.

122. The method of claim 120 further comprising the step of chromatically aligning the at least one additional frame with another frame from among the first and second and at least one additional frames, based on the brightness and contrast parameters.